

We claim:

1. A composition for use as a standardized measure of apoptosis in a test sample of tissue from a subject, the composition comprising at least one segment of an equivalent tissue that has been subjected to a treatment that reproducibly results in a predetermined, measurable amount of apoptosis in the segment.

2. The composition of claim 1, wherein the tissue is selected from the group consisting of skin, brain, heart, lung, liver, spleen, pancreas, thymus, thyroid, lymph, tonsil, stomach, kidney, bladder, intestine, testis, colon, mammary, ovary, uterus, muscle and bone.

3. The composition of claim 1, wherein the amount of apoptosis in the segment is measured as a predetermined amount of DNA damage in a TUNEL assay.

4. The composition of claim 1, wherein the amount of apoptosis in the segment is measured as a predetermined increase in amount of a biological molecule known to be increased in apoptotic cells.

5. The composition of claim 4, wherein the biological molecule is selected from the group consisting of mRNA and protein.

6. The composition of claim 5, wherein the biological molecule is a protein, or an mRNA encoding a protein selected from the group consisting of caspases, annexin, DNase I, DNase II, NUC 18/cyclophilin, transglutaminase Fas, FasL, p53, Diva, Bak, Bcl-X_s, Bik, Bim, Bad, Bid, Egl-21, Myc and Bax.

7. The composition of claim 1, wherein the amount of apoptosis in the

segment is measured as a predetermined decrease in amount of a biological molecule known to be decreased in apoptotic cells.

8. The composition of claim 7, wherein the biological molecule is
5 selected from the group consisting of mRNA and protein.

9. The composition of claim 8, wherein the biological molecule is a
protein, or an mRNA encoding a protein selected from the group consisting of Bcl₂, Bcl-
X_L, Mcl-1 and CED-9.

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10. The composition of claim 1, wherein the treatment comprises
culturing the tissue segment in a microgravity bioreactor for a period of time known to
produce the predetermined amount of apoptosis in the tissue segment.

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11. The composition of claim 10, wherein the treatment further comprises
culturing the tissue segment in a medium comprising dexamethasone.

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12. The composition of claim 1, wherein the treatment comprises
subjecting the tissue segment to a biological stress known to produce the predetermined
amount of apoptosis in the tissue segment.

13. The composition of claim 12, wherein the biological stress comprises
scalding the tissue segment.

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14. The composition of claim 13, wherein the tissue segment is a
bioartificial living skin equivalent.

15. The composition of claim 1, comprising at least two tissue segments,

FOI b 7 - D, b 7 - E, b 7 - F, b 7 - G, b 7 - H, b 7 - I, b 7 - J, b 7 - K, b 7 - L, b 7 - M, b 7 - N, b 7 - O, b 7 - P, b 7 - Q, b 7 - R, b 7 - S, b 7 - T, b 7 - U, b 7 - V, b 7 - W, b 7 - X, b 7 - Y, b 7 - Z, b 7 - AA, b 7 - AB, b 7 - AC, b 7 - AD, b 7 - AE, b 7 - AF, b 7 - AG, b 7 - AH, b 7 - AI, b 7 - AJ, b 7 - AK, b 7 - AL, b 7 - AM, b 7 - AN, b 7 - AO, b 7 - AP, b 7 - AQ, b 7 - AR, b 7 - AS, b 7 - AT, b 7 - AU, b 7 - AV, b 7 - AW, b 7 - AX, b 7 - AY, b 7 - AZ, b 7 - BA, b 7 - BB, b 7 - BC, b 7 - BD, b 7 - BE, b 7 - BF, b 7 - BG, b 7 - BH, b 7 - BI, b 7 - BJ, b 7 - BK, b 7 - BL, b 7 - BM, b 7 - BN, b 7 - BO, b 7 - BP, b 7 - BQ, b 7 - BR, b 7 - BS, b 7 - BT, b 7 - BU, b 7 - BV, b 7 - BW, b 7 - BX, b 7 - BY, b 7 - BZ, b 7 - CA, b 7 - CB, b 7 - CC, b 7 - CD, b 7 - CE, b 7 - CF, b 7 - CG, b 7 - CH, b 7 - CI, b 7 - CJ, b 7 - CK, b 7 - CL, b 7 - CM, b 7 - CN, b 7 - CO, b 7 - CP, b 7 - CQ, b 7 - CR, b 7 - CS, b 7 - CT, b 7 - CU, b 7 - CV, b 7 - CW, b 7 - CX, b 7 - CY, b 7 - CZ, b 7 - DA, b 7 - DB, b 7 - DC, b 7 - DD, b 7 - DE, b 7 - DF, b 7 - DG, b 7 - DH, b 7 - DI, b 7 - DJ, b 7 - DK, b 7 - DL, b 7 - DM, b 7 - DN, b 7 - DO, b 7 - DP, b 7 - DQ, b 7 - DR, b 7 - DS, b 7 - DT, b 7 - DU, b 7 - DV, b 7 - DW, b 7 - DX, b 7 - DY, b 7 - DZ, b 7 - EA, b 7 - EB, b 7 - EC, b 7 - ED, b 7 - EE, b 7 - EF, b 7 - EG, b 7 - EH, b 7 - EI, b 7 - EJ, b 7 - EK, b 7 - EL, b 7 - EM, b 7 - EN, b 7 - EO, b 7 - EP, b 7 - EQ, b 7 - ER, b 7 - ES, b 7 - ET, b 7 - EU, b 7 - EV, b 7 - EW, b 7 - EX, b 7 - EY, b 7 - EZ, b 7 - FA, b 7 - FB, b 7 - FC, b 7 - FD, b 7 - FE, b 7 - FF, b 7 - FG, b 7 - FH, b 7 - FI, b 7 - FJ, b 7 - FK, b 7 - FL, b 7 - FM, b 7 - FN, b 7 - FO, b 7 - FP, b 7 - FQ, b 7 - FR, b 7 - FS, b 7 - FT, b 7 - FU, b 7 - FV, b 7 - FW, b 7 - FX, b 7 - FY, b 7 - FZ, b 7 - GA, b 7 - GB, b 7 - GC, b 7 - GD, b 7 - GE, b 7 - GF, b 7 - GG, b 7 - GH, b 7 - GI, b 7 - GJ, b 7 - GK, b 7 - GL, b 7 - GM, b 7 - GN, b 7 - GO, b 7 - GP, b 7 - GQ, b 7 - GR, b 7 - GS, b 7 - GT, b 7 - GU, b 7 - GV, b 7 - GW, b 7 - GX, b 7 - GY, b 7 - GZ, b 7 - HA, b 7 - HB, b 7 - HC, b 7 - HD, b 7 - HE, b 7 - HF, b 7 - HG, b 7 - HH, b 7 - HI, b 7 - HJ, b 7 - HK, b 7 - HL, b 7 - HM, b 7 - HN, b 7 - HO, b 7 - HP, b 7 - HQ, b 7 - HR, b 7 - HS, b 7 - HT, b 7 - HU, b 7 - HV, b 7 - HW, b 7 - HX, b 7 - HY, b 7 - HZ, b 7 - IA, b 7 - IB, b 7 - IC, b 7 - ID, b 7 - IE, b 7 - IF, b 7 - IG, b 7 - IH, b 7 - II, b 7 - IJ, b 7 - IK, b 7 - IL, b 7 - IM, b 7 - IN, b 7 - IO, b 7 - IP, b 7 - IQ, b 7 - IR, b 7 - IS, b 7 - IT, b 7 - IU, b 7 - IV, b 7 - IW, b 7 - IX, b 7 - IY, b 7 - IZ, b 7 - JA, b 7 - JB, b 7 - JC, b 7 - JD, b 7 - JE, b 7 - JF, b 7 - JG, b 7 - JH, b 7 - JI, b 7 - JJ, b 7 - JK, b 7 - JL, b 7 - JM, b 7 - JN, b 7 - JO, b 7 - JP, b 7 - JQ, b 7 - JR, b 7 - JS, b 7 - JT, b 7 - JU, b 7 - JV, b 7 - JW, b 7 - JX, b 7 - JY, b 7 - JZ, b 7 - KA, b 7 - KB, b 7 - KC, b 7 - KD, b 7 - KE, b 7 - KF, b 7 - KG, b 7 - KH, b 7 - KI, b 7 - KJ, b 7 - KK, b 7 - KL, b 7 - KM, b 7 - KN, b 7 - KO, b 7 - KP, b 7 - KQ, b 7 - KR, b 7 - KS, b 7 - KT, b 7 - KU, b 7 - KV, b 7 - KW, b 7 - KX, b 7 - KY, b 7 - KZ, b 7 - LA, b 7 - LB, b 7 - LC, b 7 - LD, b 7 - LE, b 7 - LF, b 7 - LG, b 7 - LH, b 7 - LI, b 7 - LJ, b 7 - LK, b 7 - LL, b 7 - LM, b 7 - LN, b 7 - LO, b 7 - LP, b 7 - LQ, b 7 - LR, b 7 - LS, b 7 - LT, b 7 - LU, b 7 - LV, b 7 - LW, b 7 - LX, b 7 - LY, b 7 - LZ, b 7 - MA, b 7 - MB, b 7 - MC, b 7 - MD, b 7 - ME, b 7 - MF, b 7 - MG, b 7 - MH, b 7 - MI, b 7 - MJ, b 7 - MK, b 7 - ML, b 7 - MM, b 7 - MN, b 7 - MO, b 7 - MP, b 7 - MQ, b 7 - MR, b 7 - MS, b 7 - MT, b 7 - MU, b 7 - MV, b 7 - MW, b 7 - MX, b 7 - MY, b 7 - MZ, b 7 - NA, b 7 - NB, b 7 - NC, b 7 - ND, b 7 - NE, b 7 - NF, b 7 - NG, b 7 - NH, b 7 - NI, b 7 - NJ, b 7 - NK, b 7 - NL, b 7 - NM, b 7 - NN, b 7 - NO, b 7 - NP, b 7 - NQ, b 7 - NR, b 7 - NS, b 7 - NT, b 7 - NU, b 7 - NV, b 7 - NW, b 7 - NX, b 7 - NY, b 7 - NZ, b 7 - OA, b 7 - OB, b 7 - OC, b 7 - OD, b 7 - OE, b 7 - OF, b 7 - OG, b 7 - OH, b 7 - OI, b 7 - OJ, b 7 - OK, b 7 - OL, b 7 - OM, b 7 - ON, b 7 - OO, b 7 - OP, b 7 - OQ, b 7 - OR, b 7 - OS, b 7 - OT, b 7 - OU, b 7 - OV, b 7 - OW, b 7 - OX, b 7 - OY, b 7 - OZ, b 7 - PA, b 7 - PB, b 7 - PC, b 7 - PD, b 7 - PE, b 7 - PF, b 7 - PG, b 7 - PH, b 7 - PI, b 7 - PJ, b 7 - PK, b 7 - PL, b 7 - PM, b 7 - PN, b 7 - PO, b 7 - PP, b 7 - PQ, b 7 - PR, b 7 - PS, b 7 - PT, b 7 - PU, b 7 - PV, b 7 - PW, b 7 - PX, b 7 - PY, b 7 - PZ, b 7 - QA, b 7 - QB, b 7 - QC, b 7 - QD, b 7 - QE, b 7 - QF, b 7 - QG, b 7 - QH, b 7 - QI, b 7 - QJ, b 7 - QK, b 7 - QL, b 7 - QM, b 7 - QN, b 7 - QO, b 7 - QP, b 7 - QQ, b 7 - QR, b 7 - QS, b 7 - QT, b 7 - QU, b 7 - QV, b 7 - QW, b 7 - QX, b 7 - QY, b 7 - QZ, b 7 - RA, b 7 - RB, b 7 - RC, b 7 - RD, b 7 - RE, b 7 - RF, b 7 - RG, b 7 - RH, b 7 - RI, b 7 - RJ, b 7 - RK, b 7 - RL, b 7 - RM, b 7 - RN, b 7 - RO, b 7 - RP, b 7 - RQ, b 7 - RR, b 7 - RS, b 7 - RT, b 7 - RU, b 7 - RV, b 7 - RW, b 7 - RX, b 7 - RY, b 7 - RZ, b 7 - SA, b 7 - SB, b 7 - SC, b 7 - SD, b 7 - SE, b 7 - SF, b 7 - SG, b 7 - SH, b 7 - SI, b 7 - SJ, b 7 - SK, b 7 - SL, b 7 - SM, b 7 - SN, b 7 - SO, b 7 - SP, b 7 - SQ, b 7 - SR, b 7 - SS, b 7 - ST, b 7 - SU, b 7 - SV, b 7 - SW, b 7 - SX, b 7 - SY, b 7 - SZ, b 7 - TA, b 7 - TB, b 7 - TC, b 7 - TD, b 7 - TE, b 7 - TF, b 7 - TG, b 7 - TH, b 7 - TI, b 7 - TJ, b 7 - TK, b 7 - TL, b 7 - TM, b 7 - TN, b 7 - TO, b 7 - TP, b 7 - TQ, b 7 - TR, b 7 - TS, b 7 - TT, b 7 - TU, b 7 - TV, b 7 - TW, b 7 - TX, b 7 - TY, b 7 - TZ, b 7 - UA, b 7 - UB, b 7 - UC, b 7 - UD, b 7 - UE, b 7 - UF, b 7 - UG, b 7 - UH, b 7 - UI, b 7 - UJ, b 7 - UK, b 7 - UL, b 7 - UM, b 7 - UN, b 7 - UO, b 7 - UP, b 7 - UQ, b 7 - UR, b 7 - US, b 7 - UT, b 7 - UU, b 7 - UV, b 7 - UW, b 7 - UX, b 7 - UY, b 7 - UZ, b 7 - VA, b 7 - VB, b 7 - VC, b 7 - VD, b 7 - VE, b 7 - VF, b 7 - VG, b 7 - VH, b 7 - VI, b 7 - VJ, b 7 - VK, b 7 - VL, b 7 - VM, b 7 - VN, b 7 - VO, b 7 - VP, b 7 - VQ, b 7 - VR, b 7 - VS, b 7 - VT, b 7 - VU, b 7 - VV, b 7 - VW, b 7 - VX, b 7 - VY, b 7 - VZ, b 7 - WA, b 7 - WB, b 7 - WC, b 7 - WD, b 7 - WE, b 7 - WF, b 7 - WG, b 7 - WH, b 7 - WI, b 7 - WJ, b 7 - WK, b 7 - WL, b 7 - WM, b 7 - WN, b 7 - WO, b 7 - WP, b 7 - WQ, b 7 - WR, b 7 - WS, b 7 - WT, b 7 - WU, b 7 - WV, b 7 - WW, b 7 - WX, b 7 - WY, b 7 - WZ, b 7 - XA, b 7 - XB, b 7 - XC, b 7 - XD, b 7 - XE, b 7 - XF, b 7 - XG, b 7 - XH, b 7 - XI, b 7 - XJ, b 7 - XK, b 7 - XL, b 7 - XM, b 7 - XN, b 7 - XO, b 7 - XP, b 7 - XQ, b 7 - XR, b 7 - XS, b 7 - XT, b 7 - XU, b 7 - XV, b 7 - XW, b 7 - XX, b 7 - XY, b 7 - XZ, b 7 - YA, b 7 - YB, b 7 - YC, b 7 - YD, b 7 - YE, b 7 - YF, b 7 - YG, b 7 - YH, b 7 - YI, b 7 - YJ, b 7 - YK, b 7 - YL, b 7 - YM, b 7 - YN, b 7 - YO, b 7 - YP, b 7 - YQ, b 7 - YR, b 7 - YS, b 7 - YT, b 7 - YU, b 7 - YV, b 7 - YW, b 7 - YX, b 7 - YY, b 7 - YZ, b 7 - ZA, b 7 - ZB, b 7 - ZC, b 7 - ZD, b 7 - ZE, b 7 - ZF, b 7 - ZG, b 7 - ZH, b 7 - ZI, b 7 - ZJ, b 7 - ZK, b 7 - ZL, b 7 - ZM, b 7 - ZN, b 7 - ZO, b 7 - ZP, b 7 - ZQ, b 7 - ZR, b 7 - ZS, b 7 - ZT, b 7 - ZU, b 7 - ZV, b 7 - ZW, b 7 - ZX, b 7 - ZY, b 7 - ZZ

wherein one of the segments is a negative control segment which has not been subjected to the treatment and another of the segments is a positive control segment which has been subjected to a level of the treatment that reproducibly results in a maximum amount of apoptosis obtainable in the segment as a result of the treatment.

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16. The composition of claim 15, comprising one or more intermediate control segments which have been subjected to a level of the treatment that reproducibly results in a predetermined amount of apoptosis intermediate between that of the negative control segment and that of the positive control segment.

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17. A kit for evaluating apoptosis in a test sample of tissue, the kit comprising a container containing at least one segment of an equivalent tissue that has been subjected to a treatment that reproducibly results in a predetermined, measurable amount of apoptosis in the tissue segment, and instructions for use of the tissue segment in evaluating the apoptosis in the test sample of tissue.

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18. The kit of claim 17, comprising at least two tissue segments, wherein one of the segments is a negative control segment which has not been subjected to the treatment and another of the segments is a positive control segment which has been subjected to a level of the treatment that reproducibly results in a maximum amount of apoptosis obtainable in the segment as a result of the treatment.

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19. The kit of claim 18, comprising one or more intermediate control segments which have been subjected to a level of the treatment that reproducibly results in a predetermined amount of apoptosis intermediate between that of the negative control segment and that of the positive control segment.

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20. The kit of claim 17, wherein the apoptotic tissue segment is processed

for histological evaluation.

21. The kit of claim 17, wherein the apoptotic tissue segment is processed for TUNEL staining.

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22. The kit of claim 17, wherein the apoptotic tissue segment is processed for immunological evaluation.

23. The kit of claim 17, comprising one or more additional reagents for use in evaluating the apoptosis of the tissue segment and the test tissue.

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24. The kit of claim 17, comprising an extract of the soluble proteins of the tissue segment.

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25. The kit of claim 24, wherein the treatment comprises culturing the tissue segment and the kit further comprises a concentrated sample of culture medium from the culturing.